

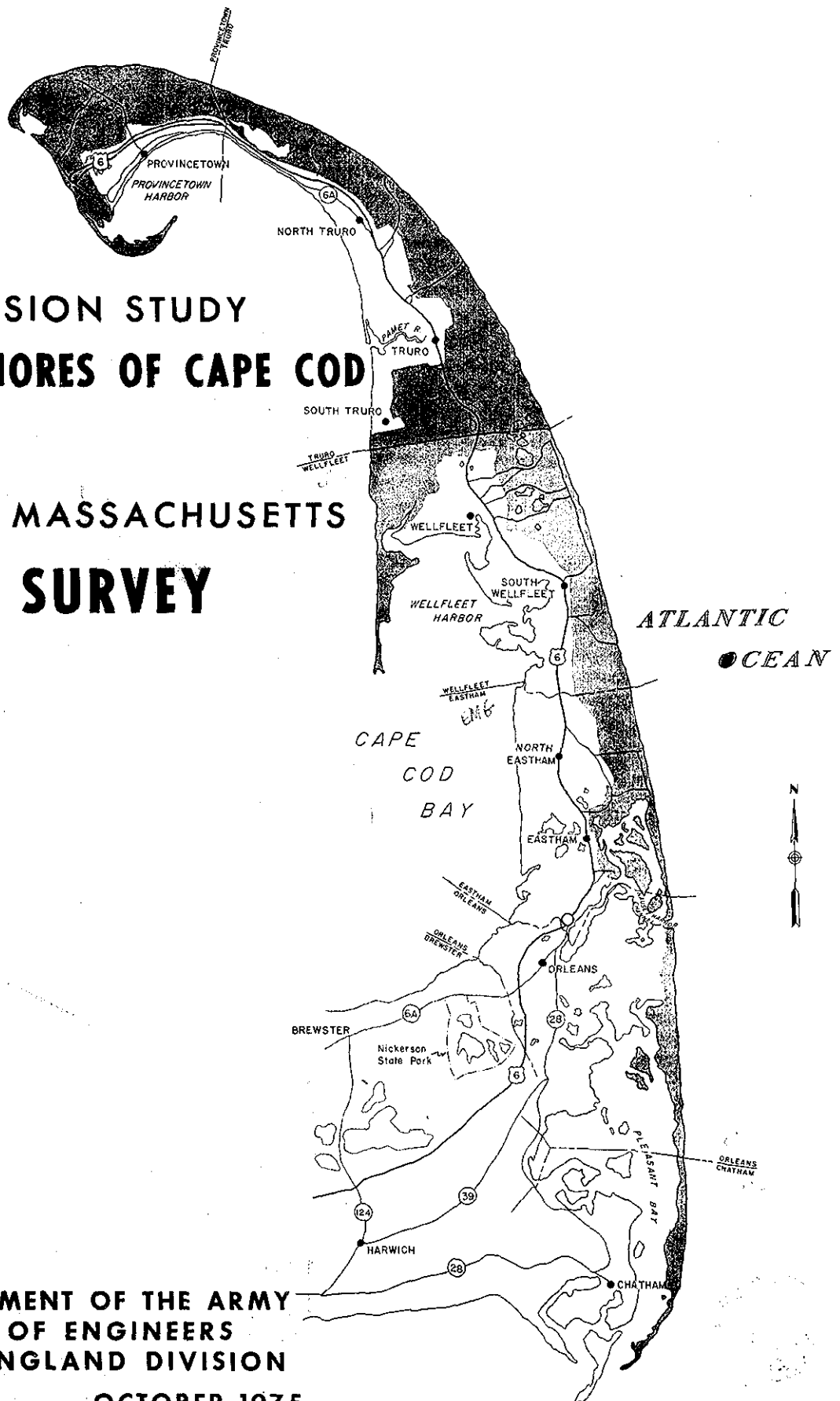
BEACH EROSION STUDY EASTERLY SHORES OF CAPE COD

CAPE COD, MASSACHUSETTS PLAN OF SURVEY



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

OCTOBER 1975



PLAN OF SURVEY

BEACH EROSION CONTROL INVESTIGATION CAPE COD EASTERLY SHORES CAPE COD, MASSACHUSETTS

PREFACE

This plan of survey presents the procedures that will be followed in the study to determine if Federal funds should be made available to assist the National Park Service and the local towns in solving the serious beach erosion problems along the easterly shores of Cape Cod.

Throughout the study, close coordination will be maintained with Federal, state, and local governmental agencies, as well as with various associations and organizations and private parties. Therefore, the plan of survey is subject to revision.

In arriving at possible solutions to the beach erosion problems along this 46 mile section of shorefront, it will be necessary to make a search of all historical data and review all completed coastal, oceanographic, and geological studies. A design and economic analysis will be undertaken, and the socio-economic conditions considered to conform to the Water Resources Council's Principles and Standards for level C feasibility reports. Of course the environmental and historical-cultural aspects will be explored. A beach erosion control survey report will be completed and will be made available for local community and National Park Service use and to others. Some sections of the shorefront may lend themselves to some type of non-structural construction, others may be best stabilized by structural measures.

In preparing the plans of improvement, all available data and historical information will be utilized, including past reports from Woods Hole Institute, towns, private engineering firms, and any work that may have been undertaken by the National Park Service.

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Cape Cod Easterly Shores

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PLAN OF SURVEY

BEACH EROSION CONTROL INVESTIGATION CAPE COD EASTERLY SHORES

CAPE COD, MASSACHUSETTS

A. BACKGROUND AND AUTHORITY FOR THE STUDY

1. HISTORY. The basic form of Cape Cod is the result of the great Wisconsin glacier (from 10 to 15 thousand years ago). The backbone of the upper Cape and the Sandwich moraine was deposited along the terminal edge of the ice sheet. A lateral moraine was deposited at right angles to the Sandwich moraine east of the present shore of the lower Cape. As the glacier receded, the ocean took over, cutting away the glacial material moving in laterally along the shores of the Cape. This process continued for many years, aided by the wind, and resulting in such features as the 39-mile sweep of ocean beach, the 15-mile scarp or sand cliff facing the Atlantic Ocean from Coast Guard Beach to Highland light, and the 8 square miles of dunes in Provincetown, Nauset Beach and Monomony Island. For fifty thousand years this great sheet of ice wrought great changes, removing literally billions of tons of soil and rock from one region and transporting it southward on a massive conveyor belt until it was redeposited along the edge of the glacier. Cape Cod was actually formed as this glacier began to retreat northward. As the glacier melted, debris in the form of boulders, cobbles, sand, silt and clay formed tombolos, sand beaches, salt meadows and hanging valleys. As the great glacier melted, plants moved in and eventually the moraine and outwash plains were covered with vegetation and mature forests of hardwood or pine. Then some 4,000 years ago man arrived. Cape Cod that you see today has been heavily marked by the hand of change. Much of this change is natural in that it results from the working of natural forces, but much of this change is the handiwork of man.

2. RESOLUTION. This study is being made pursuant to a resolution adopted 2 December 1970 by the Committee on Public Works of the United States House of Representatives and reads as follows:

"Resolved by the Committee on Public Works of the House of Representatives, United States, that in accordance with Section 110 of the River and Harbor Act of 1962, the Secretary of the Army is hereby requested to direct the Chief of Engineers to make a survey, of the easterly shores of the outer arm of Cape Cod, Massachusetts, extending from Provincetown to the southern extremity of Nauset Beach in the interest of beach erosion control, hurricane protection and allied purposes."

The study is a seven year Federal study with its beginning in 1973 and its end expected in 1980.

B. PURPOSE OF THE PLAN OF SURVEY

3. PURPOSE. The purpose of this plan of survey is to establish the procedure to be followed during the detailed study of easterly shores of the outer arm of Cape Cod. It is to be used as a guide to assist management. This plan will guide, motivate, direct and coordinate activities as the study progresses. It will:

a. Provide the planner with an advance planning tool for developing a plan of action in conducting the study;

b. Define at the earliest practicable date the anticipated problems associated with the analysis, formulation, policies, objectives, needs and scale of studies required during the course of the investigation;

c. Insure early and continuing coordination with, and services from other Federal, state and local agencies, and generate response from responsible and informed local groups. Close coordination is essential in avoiding delay of the investigation and for accomplishing a plan of improvement that is both responsible to the needs of and acceptable to the community involved.

d. Provide the Chief of Engineers with advance information on the nature of the investigation.

C. PHYSICAL CONDITIONS

4. DESCRIPTION OF THE STUDY AREA. The easterly shores of Cape Cod are located about 100 miles southeast of Boston, Massachusetts. The study area (See Inc. Map) is about 46 miles long and extends from Long Point at Provincetown to the southern tip of Nauset Beach. The area includes the towns of Provincetown, Truro, Wellfleet, Eastham, Orleans and Chatham, all within the authorized boundary of the Cape Cod National Seashore. The area under study consists of 44,600 acres of upland and submerged land within the authorized boundary of the seashore, of which 27,650 acres are considered upland. The United States owns approximately 18,800 acres of the upland, the towns collectively own 2,400 acres, and 6,450 acres are privately owned. Of the 16,950 acres of submerged land, the United States owns 4,980 acres, and the State owns 11,970 acres. There are only five areas along the open ocean available to the public with easy access to the shore; namely, Provincetown Lands, Pilgrim Heights, Marconi Station, Nauset Light and Coast Guard Beaches. Generally, a sand beach of varying width extends along the outer shore-front. In Provincetown and North Truro, the beach is wide, sloping gently and backed by high dunes. The beach then fronts high bluffs to central Eastham. There are few natural access points to the shore-front. Nauset Beach, a sand spit, is backed by dunes with the ocean on one side and Pleasant Bay on the other side.

5. EROSION HISTORY. The rate of recession from erosion along much of the shorefront in question is estimated to average 3 feet per year, with some sections experiencing a rate in excess of 8 feet per year. The erosion has progressed to the point where certain natural features and shoreline facilities are threatened. As the glacier retreated northward, the melting water poured into the ocean, causing it to rise and gradually inundate the original glacier coastline, which is thought to have been 75 to 100 miles further east than today. Evidence has been discovered of tree stumps along Georges Bank. It is fairly safe to assume that ten thousand years ago as the ice left the Cape area the melting ice released tremendous quantities of water back into the oceans and slowly sea level has risen three hundred and sixty feet. The rising sea level has engulfed the low-lying outwash plains and the combination of a submergent coastline and shore erosion has gradually reshaped the Cape to the configuration known today.

6. HURRICANES AND OTHER STORMS. The southern coastline of Massachusetts, including the south shore of Cape Cod, has experienced or has been threatened by hurricane tidal flooding. The coastline from Provincetown south to the Pleasant Bay entrance has been affected more severely and far more often by northeast storms than by hurricanes. Northeast storms that are responsible for more of the damage sustained along this reach occur during late fall, winter, and early spring. Storms with the maximum tide heights in feet above mean sea level at Boston, representative of the study area, are given in TABLE 1.

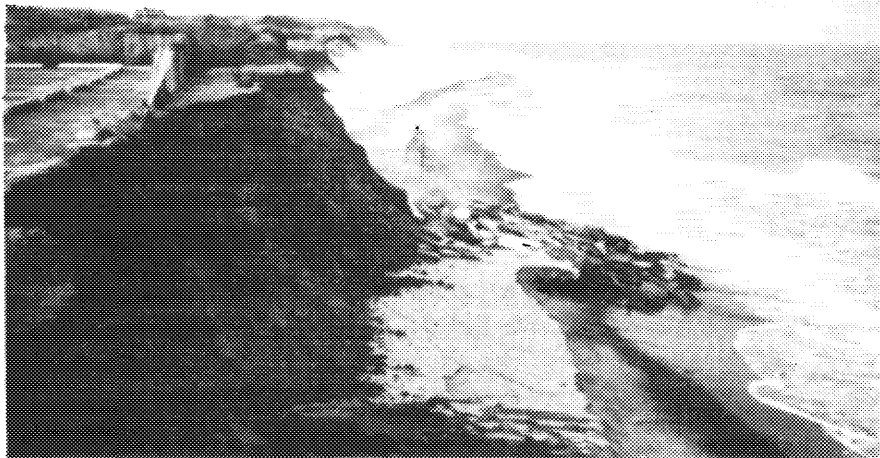


PHOTO NO. 1 . COAST GUARD BEACH - Note erosion of face of cliff.

TABLE 1

MAXIMUM STORM TIDE HEIGHTS
BOSTON, MASSACHUSETTS

<u>DATE</u>	<u>ELEVATION*</u> (ft. above msl)
24 February 1723	10.5
16 April 1851	10.0
26 December 1909	10.0
27 November 1898	9.5
29 December 1959	9.4
21 April 1940	9.0
4 March 1931	8.8
30 November 1944	8.8
20 January 1961	8.8
19 February 1972	8.8
7 March 1956	8.6
7 April 1958	8.5
28 January 1933	8.3
2 April 1958	8.3
10 November 1947	8.2
28 February 1958	8.2
7 March 1962	8.2
27 January 1933	8.1
13 April 1953	8.1
25 October 1953	8.1
1 April 1958	8.1
28 March 1959	8.1
30 December 1959	8.1
4 March 1960	8.1
21 December 1960	8.1
23 October 1961	8.1

*To convert from height above M.S.L. to height above M.H.W.
subtract 4.6' (Boston Haval Shipyard, Charlestown)

To convert from height above M.S.L. to height above M.L.W.
add 4.9' (Boston Naval Shipyard, Charlestown)



PHOTO NO. 2 . Coast Guard Beach Parking Lot At The Height Of Northeast Storm.



PHOTO NO. 3 . NAUSET LIGHT BEACH, Top of cliff is edge of parking lot. During serious winter storms toe of cliff is the mean high water line.

D. SOCIO-ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS

7. SOCIAL WELL-BEING. Cape Cod is adjacent to a region containing the largest concentration of people in the United States. Nearly one-third of the Nation's people live within a day's drive of Cape Cod National Seashore. The Cape is now a year-round resort area. Motels and motor inns, besides offering package plans, have activity programs for every member of the family. With the ever growing population in this very popular resort area and the demand for park and recreational facilities by tourists, and vacationers, the demands in Cape Cod will continue to grow. A tremendous number and variety of recreational facilities and features of interest are available to tourists visiting the region. These facilities include camping, swimming, golf, boating, and fishing. In addition to recreational facilities, the Cape boasts a host of things to see and do, including visiting animal farms, aquariums, art galleries, summer theaters and historical museums.

8. ECONOMIC CONSIDERATIONS. With the improvement of transportation and communication in the latter part of the 19th century, Cape Cod's potential as a resort area was realized. As roads and rail service improved, remote places of the Cape were settled and the tourist industry began to be "big business". This region has since long been established as an enormously popular vacation area with numerous summer resorts still retaining some of the old fishing industry. The regional labor force increases, beginning in April and extending through the month of August. This is a direct result of the seasonal tourist-vacation industry. Today, the Cape's economy is based primarily on those industries necessary to the tourist and summer resort trade. Payrolls generated by the tourist industry, in turn, support employment in other services and support industries not necessarily involved in export goods such as, banking, real estate, construction, etc. The tourist and recreational industry tie into the natural resources of the area and provide a basis of the local economy. More summer visitors are attracted to the Cape, more rental cottages, motels, restaurants, gas stations, and other facilities are built to serve them and more people are required to staff them. More retirement homes are being built. In the last several years, there has been a marked increase in the percentage of populations aged 50 and over. As a result, the permanent population of the Cape is increasing and a higher percentage of new residential construction is intended for year-round use.

9. ENVIRONMENTAL ENHANCEMENT. The resources of Cape Cod are the product of the interplay of natural processes and man's activity. These resources will inevitably be altered by the continuing interplay of natural forces and therefore, cannot literally be preserved in their present state. However, these resources and the forces which continue to shape them can be protected from abuse and alteration by man through proper management. The National Park Service, State, local

and private property owners, can plan the region to best utilize and protect the natural resources currently available to them. Regional land use must be better understood and utilized in order to provide the greatest benefit to the shoreline. Regulations and guidelines should be established to preserve the wetlands. The Commonwealth of Massachusetts has recently enacted legislation to virtually prohibit the fill-in, drainage of, or other destructive use of fresh water marsh lands. Along the Cape, the land surface is especially varied. Sand Neck in the north is characterized by sand dunes with the Great Marshes and Pleasant Bay to the south.

E. IMPROVEMENTS DESIRED BY LOCAL INTERESTS

10. HISTORICAL. The study was initiated by the six concerned towns of Provincetown, Truro, Wellfleet, Eastham, Orleans, and Chatham. At the public meeting officials stated that they are concerned about the continued loss of their shoreline which includes serious damages to nearshore parking areas. The National Park Service, the principal land owner along the shore, is concerned with the preservation of open space and beauty, with the preservation of the natural and historical features, and providing for their enjoyment by people now and in the future. It is the objective of the National Park Service to gain a little understanding of one of nature's natural processes, shoreline erosion. Therefore, the Park Service joined with the lower Cape Towns in requesting the study.

11. REMEDIAL MEASURES TAKEN BY LOCAL INTERESTS. Local interests, along some sections of the shoreline have taken it upon themselves to protect badly eroded sections of the beach. They have dumped at random, waste material, such as: reinforced concrete road sections, asphalt, etc. at several eroded areas along the shore. Unfortunately, not being properly placed or designed, this material is now being distributed along the shore. Town officials and National Seashore Park officials are in full agreement with the need for a comprehensive beach erosion control study for the area.

12. LOCAL INTERESTS. The residents are concerned with the continued loss of the shorefront including their recreational use beaches and parking area. They would like a detailed study that will provide them with technical answers to the erosion problem and possibly develop means to retard the erosion of the shore, if they are economically feasible and environmentally acceptable.

13. NATIONAL PARK SERVICE. The Service is the manager of one of our Country's most significant coastline areas. They are concerned about the ever receding shoreline and the future of the National landmark. It is with the objective of gaining a better understanding of the shoreline erosion that the National Park Service joined with the selectmen of the lower Cape towns in requesting the study. The information obtained from this study will be helpful to all concerned parties in planning their activities.

14. CONSIDERED IMPROVEMENTS. Local interests realize that from a long range standpoint, the continued shorefront recession can and will eventually effect inland developments. It is hoped that the improvements to be considered and developed can provide technical solutions and recommend means of retarding the erosion of the shoreline with particular emphasis placed on the economic, environmental and social well-being of the area.

F. OBJECTIVE OF INVESTIGATION

15. GENERAL. The shoreline is made up of dunes, bluffs and beaches consisting of unconsolidated glacial material, which is easily eroded by storm driven waves and frequent easterly storms. The basic purpose of the study is to determine and report to Congress, the advisability of providing beach erosion control improvements in the area. In accomplishing this goal, much needed useful information not now available will be obtained that will help us better understand what has happened to the area over the years and what, if any permanent solution may be economically feasible.

a. National Interest. The National Park Service owns and operates a large portion of the study area (see inclosed map). The park is open for public enjoyment of the unique natural, historical, and scientific features of Cape Cod. The preservation and knowledge of the alongshore and offshore processes will be assessed for beach erosion, recreation and other water resource developments.

b. Regional Development. The potential impact, economically, on this entire area will be evaluated based on the possible expansion of business and industry at a regional level by the increased tourist industry.

c. Environmental Considerations. The region, as a whole is faced with a challenge, a challenge which can be fully met only through close cooperation. Both the Cape and the Seashore Park have optimum capacities for development and use, which can be exceeded, resulting in severe damage to the resources. This study will be an intricate part of the overall master plan set out to outline a better understanding of how man and nature can work together to foster and promote the general welfare to create and maintain conditions under which we can exist in productive harmony to fulfill the social, economic, and other requirements of present and future generations.

d. Effects Assessment. The assessment will cover all environmental, social and economic effects following the guidelines established in ER 1105-2-105 to insure that all significant adverse and beneficial project effects are identified and assessed. The effect of the feasibility and cost of eliminating or minimizing adverse effects will be fully taken into account. ←

G. SUMMARY OF PERTINENT DATA

16. PRIOR REPORTS. The following is a list of beach erosion control and navigation studies completed by the Corps for the south shore of the Cape Cod area.

a. Beach erosion control survey report dated 2 October 1959, titled "Shore of Cape Cod between the Cape Cod Canal and Race Point, Provincetown, Massachusetts, Beach Erosion Control Study." The report is printed in House Document No. 404, 86th Congress, 2nd Session.

b. Navigation survey report dated November 1968, titled "Pleasant Bay, Massachusetts". The report is printed in House Document No. 91-430, 91st Congress, 2nd Session.

c. Hurricane report, dated 1965 titled "Massachusetts Coastal and Tidal Areas". The report is printed in House Document No. 293, 89th Congress, 1st Session.

d. Report titled "National Shoreline Study" also includes the study area. This report is printed in House Document No. 93-121.

17. OTHER AGENCIES AND LOCAL INTERESTS. All available reports, technical and historical data will be used from other Federal and State agencies as well as from concerned local interests to obtain pertinent background data significant to the study. Coordination will be undertaken throughout the study, including public meetings, conferences, and check point conferences, involving all levels of Federal, State and local governing bodies as well as civic and social leaders of each town within the study area. Interested planning and development agencies on a state and local level will also be invited to provide input during the course of the study. Coordination on a local level will be implemented through the use of public information programs.

18. PUBLIC PARTICIPATION. A public meeting was held in Eastham, Massachusetts on 28 November 1973 to obtain the views of interested parties with respect to the erosion of the outer Cape Cod shoreline. Improvements requested included working with nature to better understand the coastal processes, non-structural beach erosion control measures such as controlled access, increased vegetation and sand fencing, and the formulation of a citizens advisory committee representing the political structure of the communities and the various concerned organizations within these communities. Two more public meetings are scheduled to be held before the completion of the study and workshop meetings are to be held at various times as we proceed.

19. ECONOMIC STUDIES REQUIRED. The length of shoreline to be studied covers about 46 miles of shoreline and six towns as well as the National Seashore Park. The study area is approximately 96 miles from Boston and 225 miles from New York City. The area is serviced by U. S. Route #6, the mid-Cape highway which provides access to the shorefront, and by municipal airports and bus service. The area lies within Massachusetts' most popular recreational area. Its structure, with its stretches of natural beaches, quiet coves, snug harbors, and quaint villages attract many thousands of summer vacationers annually. Needless to say, the six towns are heavily dependent upon income and employment generated by on and off Cape tourists. One of the most important attractions that Cape Cod has to offer is its natural resources, of which the National Seashore represents a unique and integral part. Beach erosion control benefits to be derived from any proposed projects would be based on direct damage prevention and the encouragement of healthful recreation of the population by protection and improvement of dry beach areas.

20. ENGINEERING STUDIES REQUIRED. The study will be carried out in accordance to EM 1120-2-101 subject "Survey Investigation and Reports, General Procedures". Field studies will utilize private and other Federal consulting engineering firms to obtain necessary hydrology, surveying and mapping, aerial reconnaissance to determine historical data, foundations and material to sample and analyze the geology of the area. Other studies will include design and cost estimating, economics, social and environmental well-being, plan formulation, effects assessment and other studies necessary for report input.

21. PROCEDURE FOR SELECTING IMPROVEMENTS. Alternative plans will be considered and compared during the course of the planning process. Consideration will be given to formulating and analyzing alternative plans with the emphasis placed on selecting an economically feasible beach erosion improvement. The selection will be made after careful analysis of the benefit-to-cost ratio and the principle of maximization of net benefits and multiple-objectives including national efficiency, regional development, environmental constraints and the social well-being and impact on the area. Project effects, environmental, social, and economic, will be incorporated in accordance with the guidelines outlined in ER 1105-2-105 and ER 1105-2-200. Alternative plans including a detailed study on the shoreline and offshore process will be evaluated as the study progresses.

H. CONSTRAINTS AND CONTROLS

22. GENERAL. The study area is affected not only by natural processes such as waves, storms, etc., but it is greatly affected by visitors that frequent the seashore annually. These visitors play an important role in determining the demand for seashore facilities. Both the Cape and the seashore have optimum capacities. These

capacities can be utilized fully only through careful planning and close coordination with the National Park Service and concerned town planners. Present access to the seashore is inadequate, better access by means which do not pour more people into the region than can be accommodated will have to be carefully studied. The seashore and the rest of the Cape are so interrelated that neither can fully meet the challenges of the future without close cooperation with each other and with Federal, State, and local agencies.

I. STUDY PROCEDURE

23. GENERAL. The study will consider every possible available source to thoroughly determine the littoral processes throughout the study area. The report will outline in detail the following:

a. Geomorphology: A detailed summary of the formation of the Cape, the general configuration of its surface and a description of all land and water surface changes that have taken place over the years will be undertaken. Consulting A/E firms with experience in this field will be used to provide a major input in this area.

b. Shore History: A thorough analysis of all available historical information will be used to determine the shoreline and offshore depth changes. Shoreline change maps are being prepared by Cold Regions Research and Engineering Laboratory and we are planning on contacting other individuals and organizations who have developed data or who may have studied Cape Cod and vicinity. All existing protective features, structural and non-structural will be analyzed and documented. The mean historical shoreline, the most seaward recorded shoreline will be established in conjunction with determining a rate of erosion for the recorded period of time.

c. Field Assessment: A detailed field analysis of all types of shorefront structures and their condition to determine if they are man made or natural will be undertaken. This will be accomplished by personal visits to the study area, through the use of aerial and land photos. A detailed description of the entire shorefront will be included in the final report.

d. Littoral Forces: Wind, wave, current and storm data will be compiled and analyzed to determine the conditions as recorded along the study area. A complete wave analysis including refraction and diffraction studies for the entire length of shoreline will be undertaken to determine the predominant direction of littoral transport.

e. Littoral Material: The report will analyze in detail the characteristics and sources of material within the tidal range. The historical natural source of available material being transported within the study area and its characteristics will be helpful in determining the movement of material and what can be expected to occur in the immediate future.

f. Statement of Problems: The report will address itself to analyzing the various problems that prevail within the study area. It will determine the cause of the problem and recommend solutions to locals and the National Parks Service to implement to preserve the shoreline. In the recommendations, the report will consider possible cost sharing in beach construction along public owned areas.

g. Structural and Non-Structural Corrective Measures: The Cape Cod easterly shores has experienced over the years very serious erosion. We will consider the following designs: offshore breakwater, a system of groins, alongshore mound, sandfill with periodic nourishment, dune stabilization using beach grass and sand fences. Property owners will be asked to re-evaluate present zoning laws, consider a flood insurance program, and use other measures to regulate the use of the shorefront.

h. Social Aspect With and Without Improvements: Careful consideration will be given to the social impact on the area with and without the project. The population, tourist trade, labor and employment forces will be considered in all of the surrounding communities in the study area to evaluate the impact.

i. Environmental Aspects With and Without the Improvements: All possible consideration to minimize the impact on adjacent and backshore wetland, ponds, lakes and natural wildlife areas will be undertaken. Consideration with and without the project, long and short term planning effecting these areas will be considered.

j. Historical, Cultural Aesthetic Resources: The study will research, investigate, and identify all known historical and cultural sites, objects, buildings, and ruins of interest or importance in history which would be effected by the proposed project.

k. Benefits: The benefits considered for the area will be derived from, beach bathing, tourist attractions, surf fishing, dune buggy use, picnicking, sightseeing, prevention of tidal flooding, reduction in wave caused damages, loss of land, and prevention of loss of life.

l. Coordination: The study will coordinate with the National Park Service and local community groups to better understand their problems, needs and desires. Every attempt will be made to alleviate these problems and arrive at the most practical and economical solution based on our technical knowledge and expertise.

J. SUBMISSION OF REPORT

24. FINAL SURVEY REPORT. A detailed comprehensive report will be prepared including alternative methods of correcting the erosion problems and obtaining much needed useful technical information to better understand the shoreline and offshore erosion processes in the study area. Recommendations will be made and submitted to the Chief of Engineers.

K. COST ESTIMATES

25. GENERAL. Budgetary data for the Cape Cod Study is predicated upon the estimated amount of money needed to complete the work items necessary for a Level C. Study.

L. RECOMMENDATION

26. PROCEDURE RECOMMENDED. It is recommended that this Plan of Survey on beach erosion control for the easterly shores of Cape Cod, Massachusetts be approved.

TABLE 3

PLAN OF SURVEY
EASTERLY SHORES OF CAPE COD
BEACH EROSION CONTROL INVESTIGATION
CAPE COD, MASSACHUSETTS

MILESTONES

<u>Number</u>	<u>Feature</u>	<u>Date</u>
1	Initial Public Meeting	Nov. 1973
2	Approved Plan of Study	Oct. 1975
3	Phase I of Study Report	May 1976
4	Checkpoint Conference	Dec. 1976
5	Formulation Stage Public Meeting	May 1977
6	Checkpoint II Conference	April 1978
7	Submit Report Draft	Apr. 1979
8	Complete Report Draft	April 1979
9	Late Stage Public Meeting	Aug. 1979
10	Submit Report	June 1980
11	Complete	June 1980

STUDY COST ESTIMATE (PB-6)		APPROPRIATION TITLE: General Investigations			NAME OF STUDY Cape Cod Easterly Shores
		APPROPRIATION CATEGORY Surveys			
		APPROPRIATION CLASS Beach Erosion Control Studies			LOCATION Massachusetts
LINE NO.	UNIFORM COST CLASSIFICATION	FEATURE	CURRENT COST ESTIMATE	PREVIOUS COST ESTIMATE	REMARKS
(1)	(1)	(2)	(3)	(4)	(5)
1		Preliminary Planning & Public Contacts	26,800	26,000	Study cost estimate increased
2		Hydrology Studies	--	--	due to Federal pay raise and
3		Surveying & Mapping	88,500	84,000	updated cost estimate.
4		Materials & Foundations Investigations	34,300	32,500	
5		Stream Regulation Studies	---	--	
6		Design & Cost Estimates	83,300	72,000	
7		Economic Studies	49,500	47,000	
8		Real Estate Studies	---	---	
9		Special Studies			
10		Environmental Impact Statement Effects Assessment	41,100 34,600	39,000 29,500	
11		Preparation of Report	67,500	64,000	
12		Supervision & Administration	131,900	101,000	
13		Contingencies	35,000	35,000	
14					
15		TOTAL	592,500	530,000	
16					
DATE PREPARED July 1975		DIVISION New England DISTRICT		REGION New England CASIN	PAGE 1 OF 1

